

WHAT IS CLAIMED IS:

- 1                   1.     A low-noise, crossed-field device comprising:  
2                    an electrical circuit for generating a radial electrical field; and  
3                    a magnetic circuit for generating an axial magnetic field substantially  
4 perpendicular to the radial electric field wherein the magnetic circuit includes at  
5 least one permanent perturbing magnet having an azimuthally varying magnetic field  
6 impressed thereupon so that the axial magnetic field is azimuthally varying to  
7 substantially eliminate noise in the device.
- 1                   2.     The device as claimed in claim 1, wherein the at least one  
2 permanent perturbing magnet is magnetized with a number of periods of magnetic  
3 field variation.
- 1                   3.     The device as claimed in claim 2, wherein the device is a  
2 multi-cavity microwave magnetron including a cathode for emitting electrons and  
3 an anode having a number of resonant cavities and wherein the cathode and anode  
4 define an interaction space therebetween wherein interactions between electrons  
5 emitted from the cathode and the electric and magnetic fields produce a series of  
6 space charge spokes that travel around the space in an azimuthal direction and  
7 wherein the number of periods is based on the number of resonant cavities to  
8 shorten start-up time of the magnetron.
- 1                   4.     The magnetron as claimed in claim 3, wherein the microwave  
2 magnetron is a plasma processing magnetron.
- 1                   5.     The magnetron as claimed in claim 3, wherein the microwave  
2 magnetron is an oven magnetron.
- 1                   6.     The magnetron as claimed in claim 3, wherein the microwave  
2 magnetron is a lighting magnetron.

1                   7.     The magnetron as claimed in claim 3, wherein the microwave  
2 magnetron is an industrial heating magnetron.

1                   8.     The device as claimed in claim 1, wherein the device is a  
2 crossed-field amplifier including an input for receiving an input signal to be  
3 amplified within the device and an output for carrying an amplified signal from the  
4 device.

1                   9.     The device as claimed in claim 8, wherein the amplifier is a  
2 radar amplifier.

1                   10.    The device as claimed in claim 1, wherein the device is a  
2 microwave magnetron having startup and peak power phases and wherein the noise  
3 is substantially eliminated independent of magnetron current.

1                   11.    The device as claimed in claim 1, wherein the device is a  
2 linear crossed-field amplifier including a cavity region and wherein the magnetic  
3 field varies in a direction of electron drift in the cavity region.

1                   12.    The device as claimed in claim 1, wherein the device is a  
2 microwave magnetron including one of a plurality of mode control devices such as  
3 strapping and rising sun geometries, or a coaxial cavity magnetron.

1                   13.    The device as claimed in claim 1, wherein a typical magnitude  
2 of azimuthal variations of the axial magnetic field is approximately 30%-50%.

1                   14.    A microwave oven comprising:  
2 a compartment; and  
3 a low-noise, oven magnetron for generating microwaves in the  
4 compartment, the magnetron including:  
5 an electrical circuit for generating a radial electrical field, the  
6 circuit including a cathode for emitting electrons and an anode having a

7           number of resonant cavities wherein the cathode and the anode define an  
8           interaction space therebetween; and  
9                       a magnetic circuit for generating an axial magnetic field  
10          substantially perpendicular to the radial electrical field in the interaction  
11          space wherein interactions between electrons emitted from the cathode and  
12          the electric and magnetic fields produce a series of space-charge spokes that  
13          travel around the space in an azimuthal direction and wherein the magnetic  
14          circuit includes at least one permanent perturbing magnet having an  
15          azimuthally varying magnetic field impressed thereupon so that the axial  
16          magnetic field is azimuthally varying in the interaction space to substantially  
17          eliminate noise in the device.

1                       15.    The oven as claimed in claim 14, wherein the at least one  
2          permanent perturbing magnet is magnetized with a number of periods of magnetic  
3          field variation.

1                       16.    The oven as claimed in claim 15, wherein the number of  
2          periods is based on the number of resonant cavities to shorten start-up time of the  
3          magnetron.

1                       17.    A low-noise, microwave magnetron comprising:  
2                       an electrical circuit for generating a radial electrical field, the circuit  
3          including a cathode for emitting electrons and an anode having a number of resonant  
4          cavities and wherein the cathode and anode define an interaction space therebetween  
5          and  
6                       a magnetic circuit for generating an axial magnetic field substantially  
7          perpendicular to the radial electric field in the invention space wherein interactions  
8          between electrons emitted from the cathode and the electric and magnetic fields  
9          produce a series of space charge spokes that travel around the space in an azimuthal  
10         direction wherein the axial magnetic field has a number of periods of perturbations  
11         in the azimuthal direction in the interaction space based on the number of resonant  
12         cavities to substantially eliminate noise and shorten start-up time of the magnetron.

1                   18.    The microwave magnetron as claimed in claim 17, wherein  
2   the microwave magnetron is an oven magnetron.

1                   19.    The microwave magnetron as claimed in claim 17, wherein  
2   the magnetic circuit includes at least one permanent perturbing magnet having an  
3   azimuthally-varying magnetic field impressed thereupon.

1                   20.    A microwave oven comprising:  
2                   a compartment; and  
3                   a low-noise, oven magnetron for generating microwaves in the  
4   compartment, the magnetron including:  
5                   an electrical circuit for generating a radial electrical field, the  
6   circuit including a cathode for emitting electrons and an anode having a  
7   number of resonant cavities wherein the cathode and the anode define an  
8   interaction space therebetween; and  
9                   a magnetic circuit for generating an axial magnetic field  
10   substantially perpendicular to the radial electrical field in the interaction  
11   space wherein interactions between electrons emitted from the cathode and  
12   the electric and magnetic fields produce a series of space-charge spokes that  
13   travel around the space in an azimuthal direction and wherein the axial  
14   magnetic field has a number of periods of perturbations in the azimuthal  
15   direction in the interaction space based on the number of resonant cavities  
16   to substantially eliminate noise in the magnetron and shorten start-up time  
17   of the magnetron.

1                   21.    The microwave oven as claimed in claim 20 wherein the  
2   magnetic circuit includes at least one permanent perturbing magnet having an  
3   azimuthally-varying magnetic field impressed thereupon.